

Contained-In Levels and Protocol

HEALTH-BASED CONTAINED-IN LEVELS AND CHARACTERIZATION PROTOCOL FOR MEDIA AND MEDIA-RELATED WASTES GENERATED AT THE PADUCAH GASEOUS DIFFUSION PLANT

1. BACKGROUND

Because an environmental medium (e.g., soils, surface water, or groundwater) in and of itself is not defined as a solid waste, a release of a listed waste to an environmental medium does not make the medium a hazardous waste per the Mixture or Derived-From Rules. Consequently, EPA developed what is referred to as the "Contained-In" Policy to address environmental media.

In general, the "Contained-In" Policy states that when environmental media are generated and actively managed as wastes and the media have been contaminated with a listed waste, they must be managed as a hazardous waste until they are determined to no longer contain the listed waste. The process to determine if the waste no longer contains a listed waste is called a "contained-in" determination. When conducting a "contained-in" determination, the generator compares the concentrations of the listed hazardous constituents in the environmental media to regulator-approved, health-based standards. If the listed hazardous constituent levels are below the approved health-based levels and the media do not exhibit a hazardous characteristic, the media are deemed to no longer contain a hazardous waste. When the concentrations of the listed constituents are above the health-based levels, then the media must be managed as RCRA-hazardous waste unless treated below the approved health-based levels.

This characterization protocol includes the following:

- Identification of the site-specific health-based levels for use in RCRA-listed waste determinations for newly generated wastes at PGDP; and,
- An outline for a systematic approach to evaluate, characterize, and implement the site-specific health based levels for listed hazardous waste determinations at PGDP.

2. HEALTH-BASED LEVELS

This section identifies the health-based levels for TCE and 1,1,1-TCA that will be used when making contained-in determinations at PGDP. The health-based levels are established at either 10^{-6} risk level for carcinogens or a hazard index (HI) of 1 for systemic toxicants. The values for solids were derived following the protocols presented in App. B of the approved Human Health Risk Methods Document (DOE/OR/07-1506&D2, December 2000) and using site-specific exposure information. The risk assessment assumptions for soils are provided in Appendix A. Based upon site-specific scenarios, for solids, the health-based contaminant concentration level corresponding to either a 10^{-6} risk or a hazard index (HI) of 1, is 39.2 parts per million (ppm) for TCE and is 2,080 ppm for 1,1,1-TCA. Note that 1,1,1-TCA does not have a cancer risk-based screening level derived because a cancer toxicity value for this compound is not available. Therefore the proposed health based standard was calculated using the hazard index.

The site-specific health-based levels for determining whether contaminated media/debris still contains or is no longer contaminated with listed hazardous waste (TCE and 1,1,1 TCA), are as follows: TCE-39.2 ppm for solids and 1,1,1 TCA-2080 ppm for solids. These levels are presented in Table 1. The site-specific health-based levels for determining whether contaminated groundwater destined for on-site treatment and discharge through a KPDES permitted outfall (e.g., groundwater resulting from well-purging, well development, and well sampling) still contains listed hazardous waste (TCE and 1,1,1-TCA are as follows: 0.081 ppm TTCE. Groundwater that meets the health-based level for TCE shall also be deemed to no longer contain 1,1,1 TCA.

Solids that are determined to be below the levels set forth in Table 1 and that are not characteristically hazardous but that cannot be disposed in the C-746-U landfill shall be deemed to no longer contain or to

no longer be contaminated with listed hazardous waste (F001, F002, U228) and may be managed in accordance with applicable low-level waste and TSCA requirements until dispositioned to an appropriate off-site facility. The cabinet agrees to consult with DOE and the State where the off-site facility is located to reach agreement on the appropriate health-based standard for making contained-in determinations for wastes that are to be shipped to such facility. In making contained-in determinations pursuant to this document, the Cabinet is not making any determination regarding the nature or characteristic of the suspect listed waste at any time prior to the date of the contained-in determination.

Table 1
Proposed Contained-In Concentrations

<u>Contaminant</u>	<u>Solids</u>	<u>Groundwater</u>
TCE	39.2 ppm	Surface Water Standard
1,1,1-TCA	2,080 ppm	N/A

DOE may develop additional project and waste-specific health-based levels for KDEP review and approval on a case-by-case basis to address media that may be managed differently than the standard waste management practices represented by these exposure scenarios.

DOE will apply these health-based standards to the following media wastestreams at the PGDP.

Solids

Soils
Drill cuttings/sample residuals
Sediment

Aqueous Liquids

Groundwater, including purge/well
development water/sample residuals water

For the purposes of this paper, related waste is defined as wastes that are mixed with or derived from environmental media containing a listed waste (e.g., have come into contact with such environmental media). Examples of related waste include personnel protective equipment (PPE), sampling equipment, drilling fluids, and decontamination water. Also, related waste streams can be derived from the storage, treatment or disposal of environmental media that contains a listed waste. Related waste may also be referred to as secondary wastes.

Related waste streams consist of the following:

- Debris such as PPE, sampling equipment, and other materials that have been contaminated with environmental media that contains a listed waste;
- Drilling fluids and decontamination water;
- Landfill leachate;
- Wastewaters;
- Wastewater treatment media (filters, activated carbon, etc.); and,
- Wastewater treatment sludges.

Generally, related waste stream determinations will be consistent with determinations for the corresponding primary waste streams. If the primary waste stream is determined not to exceed the health-based standards, any related waste streams will be deemed not to be derived from or mixed with listed hazardous waste. However, the contained-in standards for solids, as presented in Table 1, will be applied to all debris waste streams generated as a result of site activities involving contaminated media. For example, PPE and sampling debris generated during the sampling of a monitoring well with TCE

groundwater concentration less than 39.2 ppm would not require management as a listed TCE hazardous waste.

The contained-in standards will be applied against the contaminant concentration in the media (primary wastestream) based upon process knowledge, in-situ data, or characterization data collected after generation.

For the groundwater at PGDP, the contained-in standard will be applied at the well extraction head based on the most current characterization data. Actual sampling data will be reviewed to ensure that the groundwater is handled appropriately at the point of generation.

Media and related wastes that are below the contained-in standards and do not exhibit a hazardous characteristic will be considered not to "contain" or to be derived from or mixed with a listed waste and will be managed as non-hazardous waste, subject to applicable Land Disposal Restrictions (LDRs), as discussed in Section 3.3.

3. IMPLEMENTATION

A variety of waste streams already generated at the PGDP, and to be generated at the PGDP are potentially RCRA hazardous waste as a result of contamination of an environmental media by a listed hazardous waste. As described above, DOE will use the health-based levels in Table 1 to determine if these waste streams contain listed wastes and are subject to hazardous waste management requirements.

3.1 SAMPLING AND ANALYSIS PLAN

When DOE desires to pursue a contained-in determination for a particular waste stream, for those which require additional characterization, DOE will prepare a Sampling and Analysis Plan (SAP) to collect data to support the request for a contained-in determination. The SAP will be submitted to the Cabinet for review and approval. Review and comments on SAPs and other documents being developed for a CERCLA Response Action conducted under the Federal Facility Agreement (FFA) will follow the review process specified in the FFA. For those SAPs not developed in association with an FFA scope of work, the Cabinet, within thirty (30) days of receipt of a SAP, will review DOE's SAP and either approve the SAP or issue comments. DOE will respond to comments and resubmit the plan within thirty (30) days of receipt of the Cabinet's written comments. The Cabinet will review the response to comments and the resubmitted SAP and either approve the resubmitted plan or issue additional comments within (30) days of receipt of DOE's response to comments and resubmitted plan. If the Cabinet issues any additional comments, DOE may invoke the consultation provisions of the Agreed Order.

The sampling and analysis plans for conducting sampling of environmental media and related wastes will be developed in accordance with the United States Environmental Protection Agency's (USEPA) sampling and analysis protocol as defined in SW-846, 3rd edition, or the most recently EPA approved edition.

The sampling approach for a given population of material will be tailored to the population matrix, the size of the population, and its location, either ex-situ (e.g., container) or in-situ (e.g., ditch). PPE, plastic and other debris that cannot be directly associated with a specific population of environmental media will be evaluated to determine the possibility of contamination with TCE. Since the PPE, plastic and other debris have the potential to have heterogeneous contamination within a container, the sampling protocol will be designed to be matrix-specific, and may include composite sampling, grid sampling, or other methodologies consistent with the guidance outlined in SW-846, 3rd edition, or the most recently approved EPA edition. The specific sampling approach will be detailed in the SAP and submitted to the Cabinet for review and approval.

3.2 APPLICATION OF ANALYTICAL RESULTS

DOE will determine if additional samples will be required to ensure proper and adequate characterization in accordance with SW-846 Chapter 9. Additional sampling may be required if the variance in the sample results are of such a magnitude that the calculation specified in SW-846 shows that an insufficient number of samples were collected to make a decision with the desired degree of confidence. Additional sampling may also be required if the Quality Control samples show unacceptable results (e.g., the blanks show sampling or laboratory contamination, the Relative Percent Difference between duplicate sample results exceeds the acceptable range as specified in SW-846, etc.) If additional samples are required, DOE will conduct additional sampling in accordance with the approved SAP or, if necessary, submit a revised SAP providing for the additional sampling to the Cabinet for review and approval.

DOE will review the assessed data and compare the analytical results to the health based levels as set forth herein and the Agreed Order to determine if the media "contains" a listed waste. If the analytical data indicates that the listed constituents were detected below the applicable health-based levels, the media and any associated debris would be determined not to "contain" listed waste and would not be subject to RCRA management requirements provided that it does not exhibit any hazardous characteristics. If the listed constituent concentrations are above the health-based levels, DOE will identify the wastes as listed hazardous waste requiring RCRA management, or submit a revised SAP to the Cabinet that proposes sampling each container in order to make a hazardous waste determination for each container on an individual basis, or as otherwise agreed to by the Cabinet.

Within twenty (20) days of receipt of final validated data for entry into the OREIS database, DOE shall submit its contained-in determination and all supporting analytical data to the Cabinet. The Cabinet will review DOE's determination and supporting analytical data and provide DOE with notification of any concerns the Cabinet has within thirty (30) days.

3.3 APPLICATION OF LAND DISPOSAL RESTRICTIONS

In accordance with KDEP and EPA regulations, all RCRA hazardous waste must meet the land disposal restrictions (LDRs) for the contaminants of concern prior to being land disposed. The LDRs also apply to media and debris that "contain" or are determined to "no longer contain" a RCRA regulated waste. The LDR Universal Treatment Standards (UTS) for TCE and TCA are presented in Table 2.

Table 2

<u>Contaminant</u>	<u>Nonwastewaters</u>	<u>Wastewaters</u>
TCE	6 ppm	0.054 ppm
1,1,1-TCA	6 ppm	0.054 ppm

For soils and debris, DOE will review the assessed data to determine if the media contains a hazardous waste above contained-in-levels. Soil and debris that do not constitute hazardous waste at generation may be disposed of in a subtitle D landfill. Soil and debris that are determined to no longer contain listed hazardous waste and that are not characteristically hazardous must meet LDR treatment standards prior to disposal in a subtitle D landfill. Soil and debris determined to contain a hazardous waste above contained-in levels must be treated to the LDR standards prior to land disposal. Soil and debris that contain a listed hazardous waste above contained-in levels and which have been subsequently treated to meet the contained-in levels and meet the LDR standards may be disposed of in a subtitle D landfill. DOE may apply the LDR treatment standards for contaminated soils promulgated by EPA on May 26, 1998, upon receiving a variance from Kentucky's promulgated LDRs.

At PGDP, the groundwater will be treated at a wastewater treatment unit and ultimately discharged through a KPDES outfall, in which case the LDR standards do not apply at the point source discharge. [401 KAR 31:010 Section 4(1)(b) and 40 CFR 261.4(a)(2)].

Appendix A
RISK ASSUMPTIONS AND CALCULATIONS

RISK ASSUMPTIONS AND CALCULATIONS
Site-Specific No Action Screening Values for a PGDP Contained-In Determinations

Industrial use no action direct contact risk-based values for the PGDP for trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) in soil were calculated as part of the work performed for the Human Health Risk Methods Document (DOE/OR/07-1506&D2, December 2000). In the Methods Document, these no action values are defined as the values below which no action is needed to address contamination in order to be protective of human health. These no action values were calculated using default exposure assumptions and dose equations for ingestion of contaminated soil, inhalation of particulates and vapors emitted by contaminated soil, and dermal contact with contaminated soil. The dose equations are presented in Tables D-29, D-31, and D-33 in Appendix D of the Methods Document. The exposure assumptions used in these equations are presented in Table B.4 in Appendix B of the Methods Document. The method of derivation utilizing these equations and the default exposure assumptions is presented in Section 1 of Appendix B of the Methods Document.

The industrial worker no action numbers calculated using these materials are shown in Table 1. Values in Table 1 were taken from Table A.17 in Appendix A of the Methods Document.

**Table 1. Industrial worker No Action screening values for soil
in PGDP Human Health Risk Methods document**

Chemical	Hazard-based Value (HI=0.1)	Hazard-based Value^a (HI=1)	Cancer-based Value (Cancer risk=1×10^{-6})
TCE	4.70×10^0	4.70×10^1	2.51×10^0
1,1,1-TCA	1.56×10^2	1.56×10^3	NV

Note:

All values in units of mg/kg (ppm).

HI = Hazard index.

NV = No value available for the cancer risk because analyte is not known to be a carcinogen.

^a In the Methods Document, the industrial worker no action values are calculated using a target HI of 0.1 to account for multiple contaminants. For a single contaminant, it is more appropriate to use a target HI of 1.

For the current purpose, the industrial worker default no action direct contact risk-based values were converted to site-specific no action values by varying exposure parameters. The scenarios considered, and the values used for the exposure parameters that varied most often between scenarios (i.e., exposure frequency and duration) are as follows:

- Industrial Worker A – a worker that performs grounds maintenance at a landfill and has direct contact with contaminated soil for 16 days per year over a 25 year period;
- Industrial Worker B – a worker that performs grounds maintenance at a landfill and has direct contact with contaminated soil for 16 days per year for a period of one year; and
- Landfill Worker – a worker that performs operation activities at a landfill and has direct contact with contaminated soil for 187.5 days per year for a period of one year.

Exposure parameters for these and other variables used in dose calculations are summarized by exposure route in Tables 2, 3, and 4. Toxicity values are presented in Table 5.

The site-specific exposure frequencies for Industrial Worker A and B match those used in several other projects at the PGDP and are based upon results of interviews with supervisory personnel at the PGDP. The site-specific exposure frequency for the Landfill Worker is based upon the assumption that the exposure frequency of a landfill worker would approximate that of a PGDP default excavation worker.

The site-specific exposure duration for Industrial Worker A is based upon the default rate for industrial workers at the PGDP. The site-specific exposure durations for Industrial Worker B and the Landfill Worker are based upon the assumption that exposure duration for these individuals would be minimized because contaminated materials would be quickly buried.

The site-specific no action screening values calculated using the aforementioned exposure parameters and an HI and cancer risk target of 1 and 1×10^{-6} are shown in Table 6. The smallest site-specific screening values over all receptors for each organic compound are as follows.

For TCE:

Hazard-based value (HI at 1.0) = 63 mg/kg (ppm)

Cancer-based value (Cancer risk at 1×10^{-6}) = 39 mg/kg (ppm)

For 1,1,1-TCA:

Hazard-based value (HI at 1.0) = 2,080 mg/kg (ppm)

Cancer-based value (Cancer risk at 1×10^{-6}) = None (no cancer slope toxicity value available)

Table 2. Exposure parameters used for derivation of dose from ingestion of soil

Parameter	Units	Value used
Concentration in soil = C_s	mg/kg	Calculated value
Ingestion rate = IR	mg/day	
Default		50
Industrial Worker A		50
Industrial Worker B		480
Landfill Worker		50
Fraction ingested = FI	unitless	1
Exposure frequency = EF	day/yr	
Default		250
Industrial Worker A		16
Industrial Worker B		16
Landfill Worker		187.5
Exposure duration = ED	year	
Default		25
Industrial Worker A		25
Industrial Worker B		1
Landfill Worker		1
Conversion factor = CF	kg/mg	10^{-6}
Body weight = BW	kg	70
Averaging time = AT	yr \times day/yr	70×365 (carcinogen) $ED \times 365$ (noncarcinogen)

IR for Default, Industrial Worker A, and Landfill Worker is the PGDP default value for the Industrial Worker scenario. IR for Industrial Worker B is the PGDP default value for the Excavation Worker scenario.

Table 3. Exposure parameters used for derivation of dose from dermal contact with soil

Parameter	Units	Value used
Concentration in soil = C_s	mg/kg	Calculated value
Conversion factor-dermal = CF_d	(kg-cm ²)/(mg-m ²)	0.01
Surface area = SA	m ² /day	0.43
Adherence factor = AF	mg/cm ²	1
Absorption factor = ABS	unitless	0.25
Exposure frequency = EF	day/yr	
Default		250
Industrial Worker A		16
Industrial Worker B		16
Landfill Worker		187.5
Exposure duration = ED	years	
Default		25
Industrial Worker A		25
Industrial Worker B		1
Landfill Worker		1
Body weight = BW	kg	70
Averaging time = AT	yr × day/yr	70 × 365 (carcinogen) ED × 365 (noncarcinogen)

Table 4. Exposure parameters used for inhalation of particulates and vapors emitted by soil

Parameter	Units	Value used
Concentration in soil = C_s	mg/kg	Calculated value
Conversion factor = CF	g/kg	10 ³
Exposure frequency = EF	day/year	
Default		250
Industrial Worker A		16
Industrial Worker B		16
Landfill Worker		187.5
Exposure duration = ED	years	
Default		25
Industrial Worker A		25
Industrial Worker B		1
Landfill Worker		1
Exposure time = ET	hour/day	8
Volatilization factor = VF	m ³ /kg	TCE = 3.45×10^3 1,1,1-TCA = 2.34×10^3
Particulate emission factor = PEF	m ³ /kg	3.21×10^{10}
Total inhalation rate = IR_{air}	m ³ /hour	2.5
Body weight = BW	kg	70
Averaging time = AT	yr × day/yr	70 × 365 (carcinogen) ED × 365 (noncarcinogen)

Table 5. Toxicity values by route of exposure

Analyte	Reference Dose [mg/(kg × day)]			Cancer Slope Factor [mg/(kg × day)] ⁻¹		
	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation
TCE	6.00×10^{-3}	9.00×10^{-4}	5.97×10^{-3}	1.10×10^{-2}	7.33×10^{-2}	6.00×10^{-3}
1,1,1-TCA	3.50×10^{-2}	3.15×10^{-2}	2.86×10^{-1}	No value	No value	No value

Table 6. Site-specific industrial worker no action screening values for soil

Chemical	Industrial Worker A		Industrial Worker B		Landfill Worker	
	Hazard	Cancer	Hazard	Cancer	Hazard	Cancer
TCE	7.35×10^2	3.92×10^1	7.11×10^2	9.40×10^2	6.27×10^1	8.36×10^1
1,1,1-TCA	2.44×10^4	NV	2.05×10^4	NV	2.08×10^3	NV

Notes:

All values in units of mg/kg.

See text for explanation of scenarios.

NV = No value calculated because compound is not a carcinogen.

Hazard target used in calculations is 1. Cancer risk target used in calculations is 1×10^{-6} .

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